Airport & Aircraft Safety R&D Notes

FAA's Airport & Aircraft Safety R&D Division October-December 2003

FAA COE 3rd Joint Annual Meeting

On November 4-7, 2003, the FAA and Embry-Riddle Aeronautical University hosted the FAA Air Transportation Centers of Excellence (COE) 3rd Joint Annual Meeting. Over 250 representatives from government, industry, and academia attended the forum to celebrate COE achievements, discuss current issues, and plan future activities.

In his opening remarks, Dr. Herman Rediess (shown on the right), FAA Director of Aviation Research, stated that "the nation needs innovative, new approaches to air transportation if we are to resolve our current challenges. It will take the combined R&D resources of government, industry, and universities to provide the innovative systems concepts and technology options for the future." Dr. Rediess pointed out that through COE meetings like this "we hope to foster collaborative efforts across Centers, … learn from others' experiences to improve how we operate, … and provide a forum" to exchange ideas and explore opportunities.

Dr. Herman Rediess making a presentation at the COE 3rd Joint Annual Meeting

In her welcoming remarks, Sharon Pinkerton, FAA Assistant Administrator for Aviation Policy, Planning and Environment, said that the COE program is "a new, innovative way for the FAA to do business."

Conference speakers all stressed that solutions to today's aviation challenges are a function of innovation and research and development (R&D) investment. And, in an era of decreasing resources, partnerships are an essential way to do business. The FAA's five COEs—Aircraft Noise and Aviation Emissions Mitigation, General Aviation,

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Airworthiness Assurance, Operations Research, and Airport Technology—represent significant partnerships, embracing over 100 academic and industry partners. To date, these partners have performed over 350 critical research tasks, representing an investment by the FAA, other agencies, academia, and industry of over $130 million. The resulting research products have made significant advancements in aviation science and in new technologies and procedures.

As Chris Seher, Program Director of the FAA Airport and Aircraft Safety R&D Division, said, "The COEs are providing cost-effective solutions and are playing a vital role in transferring innovative safety technologies from research to operations." But more can, and is being done.

John Kern, FAA Senior Advisor for Strategic Planning, asked the COE partners for their help in creating the future air transportation system. Kern, who leads an interagency Joint Planning Office, is developing a national air transportation system transformation plan. He said all "new ideas are welcome" and encouraged participants to "imagine the possibilities" for creating a new aviation system that is agile, scaleable, and balances the objectives of multiple stakeholders. He said that there are no simple solutions—the challenge is to keep the future system safe and robust.

Keynote speaker Ambassador Edward Stimpson, the U.S. Representative on the International Civil Aviation Organization (ICAO) Council, talked about his work on the ICAO Council and how important it is to find well-qualified individuals to fill ICAO slots. He urged the COE partners to help find qualified Americans interested in obtaining exciting international assignments with ICAO.

The 4th Joint Annual COE Meeting will be hosted by Florida International University in Miami. Further details will be available on the COE website at http://www.coe.faa.gov/ or by contacting the COE Program Director.

Pat Watts, AAR-400, (609) 485-5043

FAA Creates COE for Advanced Materials

On December 18, 2003, the U.S. Department of Transportation announced that the FAA had established a new COE: the Air Transportation Center of Excellence for Advanced Materials. The Center, awarded jointly to the University of Washington and Wichita State University teams, will conduct research, engineering, and prototype development toward the safe and reliable use of advanced materials and composites in large commercial aircraft.

"One hundred years after the first flight, this nation remains committed to leading the world in aviation technology research and development," said U.S. Secretary of Transportation Norman Y. Mineta. "This new Center will help lead America into its second century of aviation excellence."

The new Center's work will focus primarily on the safety and certification of existing and emerging applications of composites and advanced materials in commercial transport aircraft. Specific projects will include evaluating data from past applications, performing basic and applied research, and deriving standard engineering practices.

"As a world-class partnership of academia, industry, and government, the Center will support the FAA in developing policies,

standards, and training for advanced materials," said FAA Administrator Marion C. Blakey. "The Center also will play an important role in technology transfer and continued training and education in advanced materials for the aviation industry and other government agencies."

Aademic institutions participating in the new Center are Washington State University, Northwestern University, Oregon State University, Purdue University, Tuskegee University, University of California at Los Angeles, University of Delaware, and Edmonds Community College, Washington.

For more information about the FAA COE program, visit the COE web page at http://www.coe.faa.gov/.

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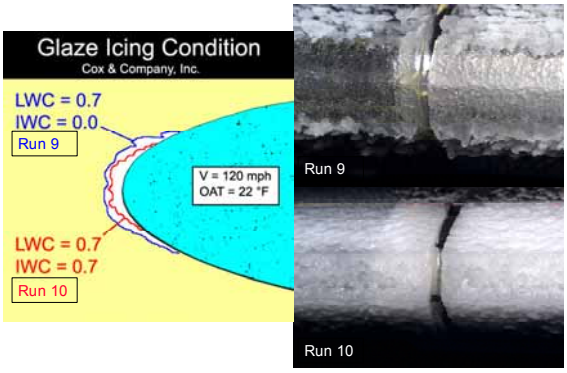
Effects of Mixed-Phase Icing Conditions on Aircraft Surfaces and Aircraft Thermal Ice Protection Systems

Most aircraft icing in the atmosphere is due to supercooled liquid droplets (droplets at temperatures below 32°F) impinging and freezing on aircraft surfaces. However, many clouds are mixed-phase clouds, containing both supercooled droplets and ice particles. The safety of flight into mixed-phase clouds has been a long-standing question, with limited scientific information available on which to base sound engineering decisions. Most information on in-flight icing is for purely liquid clouds, and certification requirements are written for those conditions. The National Transportation Safety Board has recommended to the FAA that aircraft icing certification requirements be expanded to include mixed-phase icing conditions if necessary, and the FAA has investigated the safety threat that may be posed by mixed-phase conditions.

Icing tunnel testing was conducted in the Cox & Company Icing Wind Tunnel in July 2002 using a wing section equipped with a thermal ice protection system.

The test results indicated that in mixed-phase icing conditions, ice accretion resulted mainly from the supercooled water droplets present in the mixed-phase cloud. For glaze ice, which occurs at temperatures close to 32°F, the ice particles in the mixed-phase clouds actually reduced the overall size of the ice accretion, as shown below.

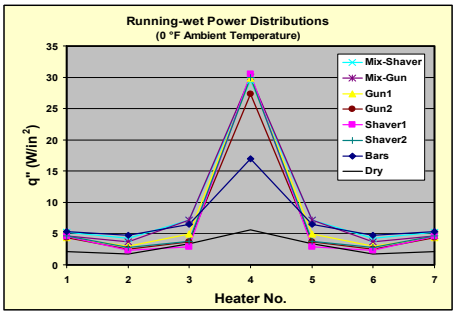


Comparison of Glaze Ice Accretions in Purely Liquid and Mixed-Phase Conditions

It is believed that this may have been mainly due to shedding or water splashing up from a surface water film (created by ice particles bouncing in the film and) to a lesser extent, due to erosion of accreted ice by the incoming particles.

The performance of the thermal ice protection system, when used in an evaporative mode (which evaporates all incoming water or ice), did not seem to be adversely affected by the presence of ice particles in the cloud. However, testing the system in a running-wet mode (which

prevents freezing in the protected region, with water running back to a less critical area) showed that the power requirements at the leading edge were much higher when ice particles were present in the simulated cloud, as shown below. The bars indicate a cloud consisting entirely of water from the spray bars, but all other conditions are either mixed-phase or consist of ice particles only. Heater no. 4 is at the leading edge of the wing section.



Power Distributions for a Thermal Ice Protection System in the Running-Wet Mode for Several Icing Conditions

This investigation used state-of-the-art simulation methods and visualization techniques that yielded unique data. Although the ice particles that can presently be simulated represent only a small percentage of the many types found in the atmosphere, the investigators believe that the trends observed in the tunnel will also occur during natural icing encounters.

This was a collaborative effort between the FAA, Wichita State University, Cox & Company, and NASA Glenn Research Center. Further details on the testing and the test results are documented in "Assessment of Effects of Mixed-Phase Icing Conditions on Thermal Ice Protection Systems," DOT/FAA/AR-03/48, Al-Khalil, K., May 2003.

James Riley, AAR-470, (609) 485-4144

Safety Management Focus Group

On December 10-11, 2003, Flight Standards Service (AFS) hosted the first meeting of the Safety Management Focus Group (SMFG), consisting of directors of safety from various carriers. AFS formed the SMFG in response to a December 2002 recommendation by the Research, Engineering and Development (RE&D) Advisory Committee that the "FAA form an airline industry and FAA partnership that uses airline safety officers to build a risk analysis safety data system to improve upon FAA's System Approach for Safety Oversight (SASO) approach." The purpose of the SMFG, as per the draft charter, is "to act as technical advisors to the FAA Flight Standards Services on concepts, requirements, and products of RE&D and other developmental efforts with respect to issues regarding the operational aspects of system safety and risk management programs within the commercial air transportation system." The goal of this initial meeting was to introduce the SMFG to the SASO program.

The SMFG plans to meet in February 2004 to finalize its charter and hold more in-depth discussions on the research projects. The air carriers participating in the SFMG include Abx Air, AirTran Airways, Alaska Airlines, American Eagle Airlines, Atlantic Coast Airways, JetBlue Airways, and US Airways.

Kathy Fazen, AAR-490, (609) 485-4100

Repair Station Training Requirements Research

In August 2001, the FAA issued a final rule that significantly changed Title 14 Code of Federal Regulations (CFR) Part 145. That rule governs foreign and domestic air agencies that perform maintenance and alterations on U.S.-registered aircraft, engines, propellers, and appliances. A new provision in 14 CFR 145.163 requires each repair station to submit a training program to the FAA and have it approved and in place no later than April 6, 2005.

The Risk Analysis Branch, AAR-490, conducted a research study to identify the current state of training and the types of training programs currently used by repair stations and to develop recommended requirements for new repair station training programs. Due to the diversity of this segment of the aviation industry, the challenge for the FAA is to create formalized training at smaller, less complex repair stations without reducing the training offered by the larger repair stations.

First, existing FAA, academic, other government and aviation industry guidance and policy documents, areas of concerns identified in governmental reports on repair stations, and program material related to the training of certificated repair station personnel and aviation maintenance technicians were reviewed. Second, industry trade associations, repair station personnel, selected FAA personnel, and other governmental agencies were interviewed to obtain data pertinent to training repair station personnel.

Recently, AAR-490 delivered to its sponsor, Aircraft Maintenance Division, AFS-300, a draft report titled "14 CFR Part 145 Approved Training Program (Research and Recommendations)." This report contains (1) a characterization of the current state of training at certificated repair stations, (2) the review the new 14 CFR 145.163 requirements and relevant FAA policy and regulatory requirements pertaining to repair station training, and (3) recommended criteria requirements for training programs for 14 CFR Part 145 certificated repair stations that perform maintenance and alterations on U.S.-registered aircraft, engines, propellers, and appliances. The sponsor will develop advisory and guidance materials to assist FAA aviation safety inspectors and industry personnel in complying with 14 CFR 145.163 requirements using these research results and related information.

Michael Vu, AAR-490, (609) 485-8143

Seher Retires

Chris C. Seher (shown on right), who has held a number of positions during his 36 years of public service at the FAA William J. Hughes Technical Center, retired on January 3, 2004. Chris, who has a Bachelor of Science degree in Physics from Drexel University and a Masters degree in Aviation Management from Embry-Riddle Aeronautical University, has had a great impact on aviation throughout his tenure at

Chris Seher, former
Program Manager, AAR-400

the Technical Center. Chris started his FAA career as a co-op student back in 1967 working at the Technical Center's Standards and Calibration Laboratories Facility. During Chris's time as the Program Director of the FAA Airport and Aircraft Safety R&D Division, he led the transition of research efforts into implementation by industry and managed research efforts that became FAA regulatory actions.

In 2002, Chris received the Associate Administrator for Research and Acquisitions Special Achievement Award. In 2001, he received the Administrator's Historically Black Colleges and Universities Program Manager of the Year Award and was the recipient of the 1997 William J. Hughes Technical Center Outstanding Leadership Award. In 1996, Chris was also recognized in Aviation Week and Space Technology Magazine as the recipient of the Laurels Award for Outstanding Achievement in the Field of Aeronautics and Propulsion.

Although Chris's time as a government employee is over, he plans to continue making a difference in aviation. He has accepted a position at Galaxy Scientific as the Vice President of Homeland Security. He will be missed by his friends and coworkers.

Cathy Bigelow, AAR-400, (609) 485-6662

In Brief

Aircraft Ice Protection System—On December 10, 2003, Chris Dumont and James T. Riley of AAR-470 and Paul Pellicano of the FAA Atlanta Aircraft Certification Office held a kickoff meeting with key members of the Aircraft Owners and Pilots Association Air Safety Foundation in Frederick, MD. The meeting was an initial step in the development of a safety advisory that will provide general aviation pilots with guidance on the differences between certified and noncertified aircraft ice protection systems. An aircraft, which is certificated for flight in known icing conditions, goes through an extensive procedure intended to ensure that it can operate safely in icing conditions. Very few small general aviation aircraft have this certification. However, many general aviation aircraft do have auxiliary ice protection equipment and systems that are designed to provide an additional safety margin in the event of an inadvertent icing encounter. Some pilots who fly aircraft equipped with noncertified ice protection systems operate aircraft as if it was certified for flight into icing conditions. The proposed safety advisory is intended to make the differences between certified icing protection systems and supplemental ice protection equipment clear. At the completion of the project, it is planned that 30,000 copies of the safety advisory will be printed for distribution.

Chris Dumont, AAR-470, (609) 485-6663

Fire Test Workshop—AAR-440 personnel conducted a workshop on December 2-4, 2003, for 30 engineers from the Aircraft Certification Office to familiarize and train them on the recently adopted new and improved fire test requirements for thermal acoustic insulation. The intense training session included lectures on the development of the final rule, service accident and incident experience, research and testing to develop the new fire test standards, hands-on instruction on both the radiant panel test (in-flight fire resistance) and burnthrough test (postcrash fire burnthrough resistance), and numerous demonstration tests illustrating the benefits of the new rule. Certification engineers will be approving thermal acoustic insulation fire

tests in the near future for compliance with the new regulation. Representatives from the regulatory authorities in Europe and Canada also attended the meeting.

Gus Sarkos, AAR-440, (609) 485-5620

Soft-Ground Arrestor—On October 22, 2003, Ryan King of AAR-411 traveled to the University of Dayton Research Institute to review the status of an on-going study on the moisture characterization of the Engineered Material Arresting System (EMAS). EMAS is the trade name of the generic Soft-Ground Arrestor System technology being installed at many U.S. airports whose runway safety area may not be of adequate size to safely decelerate airplanes in the event of an overrun.

This research study stems from a recent discovery of wet blocks in one of the EMAS. The goal of the research is to gain a qualitative and quantitative understanding of how moisture in an EMAS may affect its design performance and durability over the entire design life cycle. This study parallels efforts by the manufacturer of EMAS to identify the source of the moisture as well as effective preventative measures for keeping moisture out of the beds.

Paul Jones, AAR-411, (609) 485-6713

FAA-AANC Notes

New Test Bed Acquired—The FAA Airworthiness Assurance Nondestructive Inspection (NDI) Validation Center (AANC) acquired a retired Boeing 727 fuselage on December 16, 2003. The aircraft, which was retired near its design service goal, will now serve as a nonflying NDI test bed to assist researchers in developing and validating methods to detect widespread fatigue damage (WFD). Over the next year, the aircraft will be carefully characterized to quantify the extent of WFD in its lap splice joints. The aircraft, which was delivered with its wire bundles intact, will also be used for electrical systems research.

David Moore, AANC (505) 844-7095

Remote Site Aircraft Inspections—The FAA AANC was tasked to determine the structural condition of a DC-9 fuselage and sections cut from an Airbus 300 and a Boeing 747. The AANC and Northwest Airlines NDI Department applied several conventional and two advanced NDI techniques to verify the structural integrity of each test bed. Visual, ultrasonic, and electromagnetic inspections were used to detect cracks and corrosion in the first layer of the fuselage skin. Advanced eddy-current and ultrasonic inspections were determined to be the optimum inspection methods for distinguishing corrosion and disbonds in all inspection areas. The magnetic optical eddy-current imaging inspection method was the optimum method for distinguishing fatigue cracks in the lap joints. All areas inspected were found to be able to sustain loads consistent with their ultimate design strength.

David Moore, AANC, (505) 844-7095

Corrosion-Structured Experiment—The FAA AANC continues to work on evaluating the capabilities of various emerging corrosion detection technologies. Earlier work provided a comparison of detection capabilities of several technologies using engineered corrosion in manufactured test specimens. Part of the current effort is focused on performing a similar assessment based on the detectability of natural corrosion in panels cut from aircraft.

Additionally, an effort is underway to correlate NDI response data from engineered panels with response data from the natural panels to validate the use of engineered specimens in this type of multivariable test environment. The nature of real corrosion introduces edge definition and small pit problems when attempting to use it for the assessment of capabilities. In recent months, several companies with new or significantly improved corrosion detection equipment have expressed interest in participating in this program.

Mike Bode, AANC, (505) 843-8722

Reports Corner

- DOT/FAA/AR-03/56, Fatigue and Stress Relaxation of Adhesives in Bonded Joints, October 2003.
- DOT/FAA/AR-03/61, Silver-Sulfur Deposits on Fuel Quantity Indication System and Attendant Wiring, October 2003.
- DOT/FAA/AR-03/49, Computational Fluid Dynamics Code for Smoke Transport During an Aircraft Cargo Compartment Fire: Transport Solver, Graphical User Interface, and Preliminary Baseline Validation, October 2003.
- DOT/FAA/AR-03/70, Continuing Analysis and Surveillance System (CASS) Description and Models, October 2003.
- DOT/FAA/AR-03/34, Comparison of Actual and Simulated Smoke for the Certification of Smoke Detectors in Aircraft Cargo Compartments, November 2003.

Personnel Notes

Paul Swindell was recently hired to work in AAR-480 on the Inspection Systems Research Project, officially joining the FAA in October 2003. He worked on a detail for the previous year and a half on the Continued Airworthiness of Aircraft Engines Project. He comes to the FAA from the Department of Defense with 19 years experience in program management and engineering of aircraft maintenance equipment.

Michael Walz was recently hired to work in AAR-480 as the new manager of the Aging Aircraft Electrical Systems Research Project. In the past, he worked with the William J. Hughes Technical Center in the development of the Arc Fault Circuit Breakers as Eaton's Technical Lead for Aerospace Arc Fault.

Julian Canizales was recently hired to work in AAR-460. As a native of Columbia, Mr. Canizales received a Bachelor of Engineering (Mechanical Engineering) degree from the City College of New York in 2003. Mr. Canizales is presently supporting the unleaded fuel testing research in the engine test facility.

We welcome Paul, Michael, and Julian to the FAA and our research teams.

Upcoming Events

- International Aircraft Materials Working Group Meeting, Taj Mahal, Atlantic City, NJ, March 2-3, 2004, http://www.fire.tc.faa.gov.

- International Aircraft Materials Working Group meeting, Airport Hilton, Zurich, Switzerland, July 12-13, 2004, http://www.fire.tc.faa.gov.

- Fourth Triennial International Fire & Cabin Safety Research Conference, Lisbon, Portugal, November 15-18, 2004, http://www.fire.tc.faa.gov.

- 2004 FAA Worldwide Airport Technology Transfer Conference and Exposition "Back to the Future: Rethinking Airport Technology Research," Hilton Atlantic City Hotel & Casino, Atlantic City, NJ, April 18-21, 2004, http://www.airporttech.tc.faa.gov/att04.

- The AAR-400 Highlights FY03 are available on the AAR-400 website at http://aar400.tc.faa.gov/HighlightsFY03.pdf.

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Airport and Aircraft Safety R&D Notes is published quarterly. If you have any questions about this issue, have ideas for future issues, or know anyone who wishes to be added to this mailing list, please contact the editor, Jason McGlynn via email at jason.mcglynn@faa.gov.